AFTER FINAL
PATENT

Practitioner's Docket No.: 811_106

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Takao SAITO, Yukinori NAKAMURA, Yoshimasa KONDO and Naoto OHTAKE

Ser. No.: 10/774,454 Group Art Unit: 1792

Filed: February 10, 2004 Examiner: David P. Turocy

Confirmation No.: 9153

For: THIN FILMS AND A METHOD FOR PRODUCING THE SAME

Mail Stop A.F.
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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I hereby certify that this paper is being transmitted via EFS to the Patent and Trademark Office on *February 17, 2009.*

Christina M. Bersani

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REQUEST FOR RECONSIDERATION

Sir:

In response to the Office Action mailed October 17, 2008, Applicants respectfully request reconsideration and withdrawal of the rejections of record based on the following arguments.

Claims 1-3 and 5-9 are pending herein. The PTO has withdrawn claims 5-7 from further consideration.

Claims 1-3 and 9 were rejected under §103(a) over Yara alone or in view of Hartmann or Awazu, and claims 1-4, 8 and 9 were rejected under §103(a) over Yara in view of Mizuno. These rejections are respectfully traversed.

Claim 1 recites a method of producing a thin film using opposing electrodes, the method including a step of applying a pulse voltage on the opposing electrodes under a

pressure of 100 to 1600 Torr in an atmosphere comprising gaseous raw material including a carbon source, to generate a discharge plasma to form a thin film of diamond like carbon (DLC) on a substrate. The pulse voltage has a pulse duration of less than 1000 nanoseconds and the DLC thin film has a Raman spectrum comprising a main peak at about a wave number of 1580 cm^{-1} and a shoulder peak in a wave number range of 1300 cm^{-1} to 1500 cm^{-1}.

Yara discloses a method for producing thin carbon films at low temperature by setting a solid dielectric along an opposing plane of counter electrodes and creating a plasma by applying a pulse electric field between the counter electrodes in an atmosphere containing carbon and oxygen and/or hydrogen under a pressure near atmospheric pressure. The PTO relies upon Hartmann and Awazu for disclosing DLC thin films having a Raman spectrum allegedly near the claimed wave number values. The PTO relies upon Mizuno for allegedly disclosing an ultrashort pulse discharge plasma for forming DLC thin films under low or vacuum pressure conditions.

Claim 1 is structurally distinguishable from the cited references for at least the following reasons.

First, the DLC thin film produced by the present invention is a substantially amorphous DLC which is evidenced by the Raman spectrum that is distinctly different from the DLC thin film produced by Yara. More specifically, the DLC thin film produced by Yara has a polycrystalline structure based on the Raman spectrum main peak at about 1332 cm^{-1} (Yara, paragraph [0049]). In contrast, the DLC thin film of claim 1 has a Raman spectrum including a main peak at about 1580 cm^{-1} and a shoulder peak in the range of 1300 cm^{-1} to 1500 cm^{-1}. The main peak of 1580 cm^{-1} (G-band) is characteristic of a substantially amorphous DLC structure of good quality. The peak value of 1332 cm^{-1} disclosed by Yara is identified as crystalline diamond (see Yara, paragraphs [0049] and [0052]-[0054]).

Attached hereto is the Rule 1.132 Declaration of Mr. Takao Saito as evidence supporting the structural differences between the DLC thin film produced by the present invention and the DLC thin film produced by Yara. Specifically, the DLC thin film of the present invention is substantially amorphous DLC, which is structurally distinct from the polycrystalline structure of the DLC thin film produced by Yara (Saito Declaration at paragraphs 4 and 5).

Hartmann and Awazu fail to overcome the deficiencies of Yara because the peak values at 1475 cm^{-1} and 1548 cm^{-1} of Hartmann are caused by amorphous carbon structure impurities in the DLC and the peaks at 1590 cm^{-1} and 1500 cm^{-1} of Awazu are caused by crystalline graphite impurities and linear carbon to carbon bonds without hydrogen impurities, respectively. In contrast, the claimed main peak and shoulder peak values are physical characteristics of the substantially amorphous DLC thin film of good quality and are not due to impurities in the DLC structure. Therefore, the claimed DLC thin film is physically distinct from the DLC thin film of the asserted references.

Second, Yara specifically teaches away from using pulse durations of less than 1 ms (1000 nanoseconds) because the plasma discharge would be unstable according to Yara. In accordance with MPEP §2144.05, Yara's express disclosure of pulse durations of less than 1 microsecond are unstable, which expressly teaches away from the claimed pulse duration and, by itself, should be sufficient to rebut the PTO's asserted *prima facie* case of obviousness. Further, one of skill in the art when reading the entirety of Yara would conclude that Yara's actual enabling disclosure is limited to pulse durations of 20 microseconds (i.e., 20,000 nanoseconds) for forming the polycrystalline DLC of Yara (Saito Declaration at paragraph 9). Thus, the cited references fail to teach or suggest the claimed pulse duration.

Mizuno fails to overcome the deficiencies of Yara because the method disclosed by Mizuno requires a vacuum chamber to provide a low pressure or vacuum environment to form the DLC thin film using pulse durations of less than 1 microsecond (1000 nanoseconds).

Prior to the present invention one of skill in the art commonly understood that a time of about 20 microseconds was required to produce ion species and move the produced ion species onto the substrate in a low pressure or vacuum environment, and if Yara or Mizuno could produce and move the produced ion species onto a substrate under standard atmospheric pressure, the time required would be significantly more than the disclosed 20 microseconds because the density of molecules in the space is greater causing greater interference with the movement of the generated ion species (Saito Declaration at paragraph 8). Thus, the cited references fail to teach or suggest using pulse durations of less than 1 microsecond (1000 nanoseconds), as claimed.

Third, one of skill in the art would have had no reason to combine the references as asserted by the PTO because persons of skill in the art would not combine a pulse duration used to generate a plasma under low pressure or vacuum pressure (as in Mizuno) with a process for forming DLC under near atmospheric pressure (as in Yara) (Saito Declaration at paragraphs 10-11). Specifically, pulse durations used to generate a plasma in a low pressure or vacuum atmosphere are specific to that environment and cannot be assumed to work in a process under atmospheric pressure (Saito Declaration at paragraph 11). One of skill in the art would understand that the plasma disclosed in Yara and Mizuno would be unstable at pressures of 10 Torr, which is well below standard atmospheric pressure (Saito Declaration at paragraph 11). Further, other than the disclosure in the present application itself, the PTO has failed to provide any technical support for assuming that the pulse durations disclosed by Mizuno would be effective under near atmospheric pressure as in Yara. Therefore, absent

Applicants' own disclosure, one of skill in the art would have had no motivation to combine the pulse durations disclosed by Mizuno under near vacuum conditions with the method of Yara for forming DLC under near atmospheric conditions as asserted by the PTO.

Since the teachings of the prior art can only be combined if there is some reason to do so, Applicants respectfully submit that the rejections of record are based on hindsight reconstruction and the PTO has failed to establish a *prima facie* case of obviousness. Here, the PTO ignores the disclosure of Yara expressly teaching away from using pulse durations of less than 1 microsecond, and that the pulse durations of Mizuno were only used in a low pressure or vacuum environment, not under near atmospheric pressures as claimed.

Based on the above, the cited references fail to teach or suggest each and every element of claim 1. Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw this rejection.

For at least the foregoing reasons, Applicants respectfully submit that all pending claims herein are in condition for allowance. Accordingly, the Examiner is requested to issue a Notice of Allowance for this application in due course.

If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicants' attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,

February 17, 2009
Date

Stephen P. Burr
Reg. No. 32,970

Joseph A. Wilson
Reg. No. 53,780

SPB/JAW/cmb

BURR & BROWN
P.O. Box 7068
Syracuse, NY 13261-7068

Customer No.: 025191
Telephone: (315) 233-8300
Facsimile: (315) 233-8320